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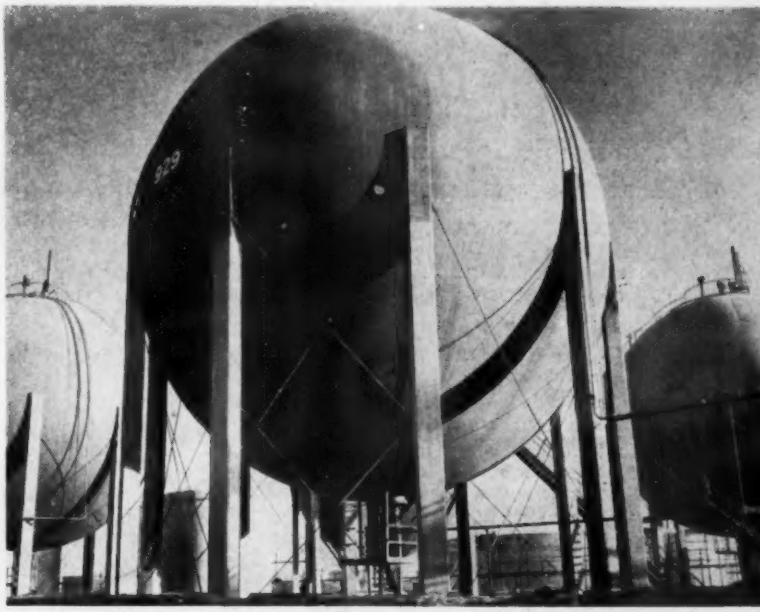


Spheroid tank used for high pressure storage. *(Photo by Rosskam, courtesy of Standard Oil Company, N. J.)*

IN THIS ISSUE . . .

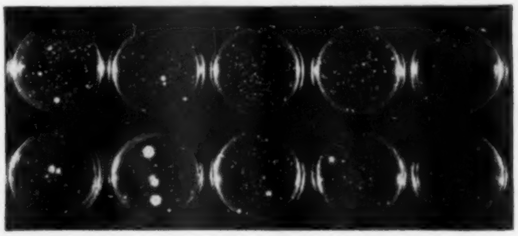
A National Service Journal

Science Shorts

ON SUBJECTS YOUR STUDENTS WILL ASK YOU ABOUT

GERMICIDAL LAMPS

G-E GERMICIDAL LAMPS disinfect the air they irradiate by killing the bacteria in it. G-E scientists, using a new portable electric air sampler, have been able to prove this fact by taking count of the germs before and after the installation of the lamps. Developed in the laboratories of the General Electric Lamp Department the germ counter, about as big as a shoebox and weighing only twelve pounds, samples the air and deposits it in culture dishes for analysis.



These culture dishes show bacteria concentration in air of crowded public place. Count of "bugs" drops as rush hour passes.

ULTRAVIOLET ENERGY of certain wavelengths will kill germs, and the Germicidal Lamp is a source of such ultraviolet radiation. The germicidal energy is produced by electric current passing through tubular lamps containing mercury vapor at low pressure. The principle is the same as that used in all fluorescent lighting. A gas can be made to glow by bombarding it with electrons. When this is done, other electrons are knocked out of their places in the gas atoms, and as they fall back light energy comes out. The tubes contain argon and mercury vapor. First the electrons make the argon glow, and this in turn starts the mercury producing ultraviolet.

The difference is that here the primary objective is the creation of ultraviolet rays while in fluorescent lamps it is the creation of visible light. Thus in fluorescent lighting the inside of the tube is coated with phosphors which glow when struck by the rays. In the germicidal lamps no such coating is used and consequently the ultraviolet rays themselves are given off.

THE ENORMOUS FOOD WASTES caused by mold can be controlled by these lamps. The woolly mold formation is a plant that grows from tiny microscopic mold seeds that are floating on air currents everywhere.

Although germicidal energy of this nature will not completely eliminate the possibility of contracting disease communicable by air borne bacteria, it is a proven fact that it will kill many of these bacteria.

Many food processors are using these lamps to reduce mold losses—hospitals, schools, and similar institutions are using them to disinfect the air.

It has been definitely proved that better preservation of fresh meats, with less spoilage, follows the installation of General Electric Germicidal lamps in meat coolers.

This advertisement is one of a series, designed as a service to teachers of question-asking boys and girls. General Electric Co., Schenectady, N. Y.

GENERAL ELECTRIC

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The Science Teacher

VOLUME XIII DECEMBER, 1946 NUMBER 4

The Mysteries of Life

In the realm of physical reactions of living tissue nature has many secrets that the bio-physicist is now attempting to fathom and supply some of the missing links in the knowledge gleaned by the biochemist and biologist. Dr. Bartlett points out in this article many unsolved biological problems which may yield to the methods of the physical sciences. This presentation will also interest teachers who wish to counsel students concerning the areas of specialization in the sciences.—Editor.

JAMES H. BARTLETT

Professor of Theoretical Physics, University of Illinois

MEN HAVE long wondered what life is and how it may be prolonged. Within the past few decades, however, the wonder has been supplemented by active and widespread research. As a result, we now know about such things as vitamins, hormones, and sulfa drugs, and can combat effectively many diseases. The conquest of cancer seems to await the acquisition of a great body of knowledge about the mechanism of growth itself. When we have this, we shall probably be near to the solution of the problem of the lengthening of the life span.

The ever accelerating progress in biology is due in large measure to the aid from chemistry and physics, which are quantitative sciences. The biologist had first, with simple and direct techniques, to learn about the structure and gross functioning of living things. This qualitative phase is now about complete, and more powerful methods are needed to determine basic mechanisms. Progress has been slow because of several factors. First, many biologists are vitalists or animists even now, and steadily resist the idea that life processes can be explained in terms of physics and chemistry, probably because such an explanation has been supposed (erroneously) to imply denial of free will. Secondly, few biologists have had sufficient training in physics to be able to analyze the complicated phenomena or to make speculations concerning probable mechanisms. Thirdly, only a handful of physicists have as yet been bold enough to attempt application of their knowledge to biological problems. Future advances in fundamental biology will require major assistance from physics and chemistry, and many biophysicists and biochemists will be needed.

WHAT IS LIFE? Living things are, by definition, those which have certain properties or functions, such as metabolism, respiration, growth, and reproduction. For life to be supported, there must be the right chemical elements present, and the organism must exceed a certain size in order that it can behave in a sufficiently complicated way. The biochemist has not as yet synthesized a living thing, nor even a protein, but there is no apparent reason why this will not be done eventually.

What is consciousness? It is a state in which the organism is aware of its environment and can apparently act voluntarily. Here it is the nervous system which must be sufficiently complex before consciousness can exist.

Life and consciousness are to be regarded as consisting of certain physical processes, and it is up to the scientist to learn enough to be able to control the rates and directions of these. In this way, it might prove possible to alter the speed of thought processes, to change the rate of growth, to cure cancer, and to prolong the normal life span.

The attempts to control cancer should be directed toward prevention, although it is immediately of importance to use the quasi-surgical methods of radiative destruction of cancerous growths. Non-destructive, delicate methods of investigation must be developed if we are to understand the causes and nature of malignancy. The biochemists have already

done much in a qualitative way, but the work should be supplemented by information about rates and how they may be influenced.

Biochemistry, or the application of chemistry to biological problems, is already a flourishing science. The biochemist seeks to learn what substances are necessary for the maintenance of a particular process, for survival, or for adequate nutrition. He determines the detailed steps of various types of metabolism in general (proteins, fats, and carbohydrates) and of muscle, nerve, etc., in particular. At times, he may use physical methods, as when he ascertains the fate of particular atoms by tracer techniques. Such overlapping with biophysics will become greater as more and more biological problems are solved.

BIOPHYSICS, or the use of physical methods and techniques to solve biological problems, is as yet in its infancy. Together with biochemistry, it should provide answers to all questions of basic mechanism. The biochemist studies the structure of the molecules and how various reactions proceed, while the biophysicistis concerned with the motion of the molecules or ions. Some problems which have already yielded quantitative results, and others on which work should be done, will now be listed.

1. *Nature of Chromosomes.* Early workers measured the effects of X-rays, μ-rays, and other radiations on tissue and on chromosomes. This gave a rough idea of the way in which alterations such as mutations, translocations, and inversions could be brought about, and rendered more precise the notion of the gene. The actual chemical nature of the chromosomes will probably be found by more delicate methods, such as subjecting them to various chemical agents. The center of interest has recently shifted to viruses, which are probably similar to chromosomes but more amenable to detailed study.

2. *Virus reproduction.* When a bacterial virus (bacteriophage) is placed near a bacterium, it may enter after some time has elapsed. Pictures may be taken with the aid of an electron microscope, and it is observed that the bacterium, after a definite period, breaks up. There may now be many viruses, reproduction having been fostered by the nutrient material of the bacterium. The problem for the future is to determine what nutrient material must be present for reproduction to occur. Once we have this information, it should not be too difficult to construct a picture of the mechanism of reproduction.

3. *Cell division.* The ordinary cell goes through a well-defined sequence of changes. Most of the time is spent in the resting stage, during which period the materials are assembled and ordered so that division becomes possible. A chromosome catalyzes the formation of its sister beside it, and then conditions change so as to favor separation of the two. The cell divides, and the process is repeated. The problem here is to find what factors influence the length of the resting stage and the durations of the phases of division. If we know the mechanisms of reproduction and of cell division, it may become possible to change the rates, especially since these events are of common occurrence and may not depend too critically on the kinds of chromosomes present. It should certainly be possible to produce mutations more readily than now.

4. *Rhythmic activity.* Cell division is repeated many times, probably as long as there is adequate nutrient, and can hence be regarded as a rhythmic process. Such processes are common (heart beat, breathing, transmission of nerve impulses, brain waves.) We must account for the period and wave form of the rhythm in terms of ionic and molecular motions.

5. *Specialized organs.* The study of various characteristics or functions is made easier because of the organs where these occur predominantly. Glands secrete certain substances, nerves cause signals to be transmitted, and muscles contract. When once we understand the mechanisms in specialized organs, we shall be in a position to explain the occurrences where several processes are all taking place at once and are of the same order of importance. Such is probably the case in the ordinary cell.

6. *The nervous system.* External stimuli fall on a receptor organ, such as the eye, and evoke a volley of impulses along nerves to the brain. A decision for action may be made, in which case a second volley is sent along motor neurones to the muscles, caus-

Continued on Page 89

Reorganizing Biology[1]

To Meet the Needs and Interests of Youth

PAUL F. BRANDWEIN

Head of Science Department, Forest Hills High School, Forest Hills, New York

It was Daedalus who proclaimed that the steel he forged was not intended to make men happy, but great. Science in the service of society, can help make men happy as well as great. For if it helps solve problems of living, serves men's needs, prolongs his life span in comfort and productiveness and health, it becomes a power to conjure with. Then science serves life and living.

Teachers of science are in a curious position. They serve equally through science and through their communities. They are the ones who, more than any other group, can make man live with science, can show man how to use science to improve life and living. It is for this reason that these teachers are on the perpetual search for philosophies, for content, for methods which will make science teaching more meaningful. Science teachers want to make science as important to young people as it is in their lives.

True, science is an adventure. It is a thrilling experience, replete with stories of man's conquest of his enviroment. Any teaching in science which is not dripping with fatigue, which is vigorous and imaginative, will stress the adventurous spirit of science and the scientist. But as an underlying philosophy for science teaching which will contribute to man's understanding of science in the service of society, of scientists doing in order to know, of the impact of science in man's daily life and living, it falls short. It falls short because it doesn't call forth the type of dedication which we have come to expect from the scientist and teacher.

Science explains our environment. It does just that. We explain the nature of air, water, light, etc., in relation to man's experience. But science is more than that, it is experience in search of meaning. It is a body of information. It is a body of technological devices. It is a method of thought. All these are necessary outgrowths of any study of science and are the warp and woof of good teaching. Yet these characteristics of science are not satisfying as an underlying philosophy in teaching. For these attributes of science are curiously the cause as well as the result of man's quest for the better life, of his desire to improve that life and free himself of its vexations. Science, per se, we think, is not basic. Man's needs are.

Science serves life and living. It is the "brain" tool by which man has conquered his environment. A man and amoeba have somewhat similar biological needs. But there the similarity ends. Man uses his resources of soil, air and water to improve his life and living, to lengthen his life span, to order his indoor climate, to preserve his food. Science doesn't use man. Man uses science. He has used science to develop a cultural climate. He uses it to meet his needs. He uses it to conquer his environment. He uses it to meet new problems. And because he has a brain which enables him to learn and invent, discriminate between values, plan for and predict some future events, he can and does pass on to his offspring his methods of meeting his needs and solving problems. This the amoeba cannot do. A valid underlying philosophy, it seems to me, is this: Science serves life and living. Man has certain needs; he must meet the essential problems of life and living. How has he used science towards this end?

If we accept this philosophy, a broad understanding will permeate our science teaching. Not the garget nor the adventure. The relevant thoughts will be around understanding what our control of material and energy resources has done for life and living. The relevant thoughts will center around gaining increasing control over our environment, increasing our life spans, banishing disease and accidents. This is the philosophy which we may expect to find permeating science in a program of general education.

1—Address given at the Annual Meeting of the National Science Teachers Association, a section of N.E.A. at Buffalo, New York, July 1, 1946.

Once we accept the philosophy that science should meet the needs and interests of youth, we may examine the pervasive and specific objectives of science teaching, its content, its techniques and procedures of evaluation in the light of a fundamental characteristic of good teaching, namely, selection. The good teacher constantly selects from the vast experiences of mankind those which may produce desirable changes in the young people he leads. The kinds of experiences he will select should depend on the students he teaches, on a knowledge of their gifts and opportunities. Unfortunately, in many instances, the kinds of experiences he selects are often circumscribed by inadequate training, by poor facilities, by unsympathetic administration, by rigid adherence to courses of study. All too often, a syllabus or textbook is taught—not the student.

Now this isn't educational jargon. The acceptance of a teaching philosophy based on the needs and interests of students precludes rigid courses of study, inflexible teaching procedures, unsympathetic administration. But it does not mean that the experiences around which the course is organized are derived entirely from the students' interests. A need is defined as an interaction between the student and his community.

The student's personal problems are important, but their solution be they personal, social, or economic, depends on the community, its needs and its interests. The student's interests serve as motivations, not as end.

To be specific, Mr. Syllabus our teacher who depends on a more or less rigid course of study knows what he's to teach before he meets his students. When he meets them, he may ask for a definition of biology, or ask for a definition of life, or parade the animal kingdom before them, or tell them just what he expects, how he wants notebooks or homework done. This is not to say that a syllabus cannot be based on the needs and interests of students. An outline of such a syllabus is suggested in a recent article.[2] But most syllabi are based on what the teacher thinks his student's interests are (on the past, so to speak) and not on the interests of the class he *will* meet.

Mr. Needs our teacher who will plan his work around needs and interests, knows several things before he meets his students. He has made a study of the community in which his students live. He knows the nutritional levels, the diseases which kill and maim, the needs and interests of the majority of people in the community and the opportunities available for biological experiences. When he meets his students, he meets them as a guide and as an experienced friend. He will ask—"What do you want to know?" What do you need to know to be fitted for life in your community in this world?

His class, of which he is an important but not the whole part, will take a week or so to plan the course of study for the term. This friendly cooperative planning enables Mr. Needs to gauge the interests and needs of his students. He establishes a rapport which Mr. Syllabus usually never attains. And in so doing the students will participate in a characteristic activity of the scientist—careful planning to solve problems. Mr. Needs recognizes that there is all the difference in the world between teaching subject matter as an end in itself and teaching subject matter to solve problems of living in a specific community.

A case in point is my observation of a teacher who taught reproduction in spirogyra and amoeba, frog and bird, yeast and flowering plant in a community where the syphilis rate was amongst the highest in the country. He did not teach human reproduction. It was not in the syllabus. Neither did he teach the nature and prevention of disease. This, too, was not in the syllabus.

Reorganizing biology teaching to meet the needs and interests of youth involves first, a willingness to meet youth halfway in planning content. It involves, second a reorientation of content. The course is organized not around Spirogyra, Hydra, Planaria, the earthworm and the pea, but around man. And it is time biology teachers placed their emphasis on human biology. The course content at once becomes significant, teaching becomes mean-

2—The Modern Role of Biology Teaching. Brandwein, Paul F., Teacher's College Record, January, 1944, p. 265-271.

ingful, the goals are clear and justification for teaching biology is found in every day's work. Experimental data falls into a proper framework.

The content of a course organized around problems of living generally centers around these areas: nutrition, human physiology, behavior, disease, the life span, heredity, evolution and anthropology, and biologic production.

These are not in order of sequence nor of emphasis. The amount of time spent on each topic depends to a large extent on student interests and needs and the needs of the community. But on the basis of my experience, students who have been given an opportunity to plan a course make suggestions which fall generally in the areas mentioned above.

It is well to repeat that the teacher's participation in planning is not passive. He brings his experience and knowledge of community needs into the discussion. But he does not force his point of view. The majority of students may reject one or more aspects of the work. But they find as they go through the term's work that they need to modify their plans as their intrests and experiences enlarge.

To be specific. In a group in a city school, a student suggested that it wasn't enough to study their own nutrition, that we needed to understand how food was produced. The class disagreed but expressed the desire to know more about his point of view. The teacher asked the student to plan such a unit of work, with suggested activities. The student showed the class how urgent was the need for conserving our natural resources, how the wealth of a nation depended on its soil, how food grown upon poor soil lacked the essentials of good nutrition, how man needed to wage a constant fight against the forces which destroyed his high level of biologic production. He outlined a series of field trips, experiments and museum trips. He won the class over—and he became the chairman of a small committee to plan the work in detail.

Another case in point was a unit in Behavior. The question of tropisms arose. Two students were interested in working with plant and animal tropisms. While the class could understand the need for working with insect tropisms in order to control insect vectors and pests, and plant tropisms when they studied biologic production, they did not agree that there was a need to spend valuable school time on such items as the galvanotropisms of paramoecium. However, these two students agreed to explore the topic of tropisms as a term project. They did an excellent piece of work, reported to the class and are now extending the work in a distinctly original direction.

In still another case, the class became interested in human phychology. They agreed to do certain readings in the field of diseases outside of school (because they realized the need for this knowledge) in order to conserve school time for work in psychology. They "contracted" to do this work in diseases within a month; the teacher gave them a "contract" specifying topics, readings and references. Then the activities planned were carried on in the laboratory after school and during free periods. Several days were spent in summing up the "contracts," in clarification of questions, in planning further work on the control of the diseases of youth, and of old age (the so-called degenerative diseases) and on venereal disease.

Classes taught by this method have consistently shown high results in the New York State Board of Regents and in College entrance examinations. They read more, do more, take more science than do students of equal intelligence (measured by I. Q., reading score and background) taught by the same teacher under conditions where cooperative planning is eliminated, where the state syllabus is adhered to strictly, where subject matter is a primary goal and not the interests and needs of students. And what is most surprising is that students who participate in such learning know such details as conjugation in spirogyra and bread mould, budding in hydra and other minutiae which have little or no bearing on their own problems of life and living. It seems that they are strongly motivated to read

Continued on Page 86

The Road Ahead for Science Teachers

MORRIS MEISTER

President of NSTA

AT LONG LAST public opinion is behind the teacher in his demand for more adequate compensation for his services to society. For the first hime in a century, the public press has acknowledged with dramatic vigor that good education for our children cannot possibly come from teachers who are compelled to scrimp and worry in order to maintain the appearance of economic respectability. This support by the public has brought and is bringing concrete results in thousands of communities, though not everywhere. We can be reasonably optimistic that salary adjustments of some kind will become universal in the near future. While the science teacher will share this long overdue recognition with the rest of his colleagues, there are other professional problems which he faces which can only be solved through his efforts alone. There has never been a better time for concentrating attention upon these problems. Public opinion will respond if our professional needs are presented dramatically. The next few years will be the most critical that science teachers have ever faced. Great promise awaits us along the road ahead if we work intelligently together on a national basis.

Our first major effort should concern itself with presenting a united front. We must prove to our colleagues and to the public that we have profound faith in the contribution which science can make to the welfare of mankind. We must think first of this potential contribution in the program of education that we propose. If we have this faith, we will give priority to science as a whole rather than to some smaller division of science in an air-tight compartment. If we have this faith, we will be concerned with strengthening our national organization because it will make our local and regional groups more effective.

WE MUST dedicate ourselves to more time for science in the school curriculum from kindergarten through college. The theme of our 1946 Yearbook must become a slogan for all to hear and to heed. Boards of Education, Superintendents and Supervisors must be made aware of our claims in the work of the classrooms of the nation.

The public is quite ready to agree that science teachers have a crucial role to play in an atomic age. After our statesmen have labored long and hard to establish reason and peace among nations, and after our political scientists and philosophers have formulated bases for social and economic conduct within and among countries, there is still the task of education in science to be done if blueprints are to become realities. This task is in the hands of science teachers.

Science teachers must rededicate themselves to the two great objectives of our time: first, a better science education for all American youth; second, the discovery and cultivation of science talent among youth. Unless this is done, the blueprints cannot become realities and science will fail to serve mankind. Here, too, a major task is in our hands.

IF ALL OF THIS is to be done, then science teachers must have more than just an increase in salary. They must demand conditions of work which will make their professional service to society possible. Their teaching load must be reduced. They must have adequate equipment for teaching. They must insist upon a renaissance of meaningful laboratory work. They must be given time in which to capitalize on student interests in after-school science clubs and student projects. Since effective science teaching is so uniquely dependent upon apparatus and experiments, adequate laboratory assistant personnel must be provided. Finally, science teachers themselves, through their national organization, must insist upon competency in science teaching. They must join with teacher-training institutions in the setting up of proper programs for pre-service training. They must have a voice in determining the kind of useful in-service training and supervision to which all teachers are entitled.

NSTA Recommends Science Equipment for European Schools

This study and report was made at the request of the State Department of the United States.

A DEVASTATED European school can set up an elementary science program for $547.68 and properly equipped laboratories for high school chemistry, physics and biology for about $6,500, according to a comprehensive report of science course content and teaching apparatus used in the schools and colleges of the United States prepared by the National Science Teachers Association with the assistance of the Cooperative Committee of the American Association for the Advancement of Science. Undertaken at the request of the State Department for presentation to the preparatory commission of the United Nations Educational, Scientific and Cultural Organization and sponsored by the Scientific Apparatus Makers of America, the report is both the first analysis by an outstanding group of scientists and educators of representative science teaching practices at all levels (with special emphasis on college courses), and a detailed listing of the scientific equipment necessary to conduct such courses.

The preface to the entire report stresses that the committee accepted its assignment on the basis that it would compile lists of apparatus and descriptions of science laboratories to serve as a basis for reconstructing war-ravaged schools and, since such lists would have little meaning unless they were accompanied by a description of the course content, a statement would also be prepared citing the aims which the laboratory materials are designed to serve. Therefore, preceding each of the sixteen sections of the report is a statement detailing the major objectives of science teaching at this level or in this area which is followed by a general outline of course content. These outlines are not of ideal practices but of representative ones as they currently exist in science teaching throughout the nation.

For example, in the section on general science, it is pointed out that general science in grades seven through nine is the most nearly universal of the science courses studied by pupils in the public schools of the United States. The course is customarily an over-all study of many areas of scientific knowledge each of which at a later date represents a specialty. Instruction is characteristically a study of experimental demonstrations performed by the teacher, often with the pupils' assistance. Schools follow numerous patterns in presenting the material covered by general science classes, varying from special topics allocated to each of the three junior high school grades to a core development in which scinece is integrated with subject matter from other areas.

FOLLOWING this introductory statement there is a list of the 22 different topics representative of the content commonly included in general science courses, ranging from animals to weather. Then comes an exhaustive list of the apparatus and supplies necessary to equip a school having 200 pupils distributed in the seventh, eighth and ninth grades. Each item of equipment from an air-pump for $12.50 to a thistle tube for 15¢ is described and priced. The total equipment cost is $815.30, which could be pared down to $710.55 by eliminating certain desirable but less essential items.

The bulk of the report deals with the science programs intended for college students and reflects the extent to which liberal arts colleges in America offer a variety of opportunities for scientific study and specialization. Eight of the possible areas of specialization—astronomy, bacteriology, botany, chemistry, geology, mathematics, physics and zoology—are covered in considerable detail. The inclusion of such a wealth of material on college practices further reflects the fact that while elementary and high schools were casualties of war, colleges and universities were targets for destruction, especially in their facilities for scientific study and research, and the need

Continued on Page 92

A Challenge to Youth*

KARL T. COMPTON

President, Massachusetts Institute of Technology

KARL T. COMPTON

OVER A YEAR has passed since hostilities ended; the whole world continues its struggle to restore some semblance of equilibrium to economic, social, and political life. Not the least of the tasks we face is the replenishment of our greatly depleted supply of properly trained engineers and scientists, to help meet the many problems which have come in the wake of a six-year war.

Let us take a look at three significant developments of the war years, significant because they foretell some of our future needs. First, virtually all of the technical talent of the United States has focused its attention on the development of equipment and techniques for the single purpose of winning the war. No one will question the thesis that the job had to be done, nor the conclusion that the effort met with success. Yet, much of the work was directed toward destructive ends—or defense against destruction. Even though a great deal of the research will have peacetime application, we have undoubtedly lost ground in our constructive efforts constantly to improve the standard of living. Further, we have drawn heavily on our reservoir of fundamental scientific knowledge because most of the war research concerned the *application* of science and any basic research was incidental to the major task. We must therefore promptly replenish the supply of the "raw materials" of engineering and science.

The 1946 Westinghouse Talent Search winners on the Capitol steps.

Second, American industry became aware of the usefulness of scientists and engineers on a much broadened scale. Almost every company producing war equipment found itself dependent in some way on technical manpower. That this trend will continue in peacetime is borne out strikingly by a survey recently conducted among 125 companies throughout the United States by a committee of the American Society of Engineering Education. The results indicate that the future annual demand for engineering graduates will be more than twice as great as before the war.

Third, the United States, unlike any other country during the war, has drained off the supply of young technical men and drastically curtailed the number of students in training in engineering and science. Despite the increased military and civilian demands during the war, the number graduating from engineering schools has declined steadily to a low this year of less than 7,000, including those in Army and Navy sponsored programs. This compares with a normal complement early in the war of almost 15,000.

*Reprinted in part from *The Educational Focus*, December, 1946.

All of these developments point to the immediate need for increasing the education of engineers and scientists at the fastest possible rate. The colleges and technical schools are keenly aware of the problem and they are doing everything possible to increase the capacity of the schools to meet the situation, yet the deficiency in technical manpower will not be wiped out until 1952 at the earliest. In the near future, the normal flow of young men from secondary schools plus the backlog of qualified GI's will provide an adequate supply of candidates for technical training to permit us to make up ultimately for the current deficiencies. The GI Bill of Rights will remove the economic barrier to a college education for many ex-servicemen who would have found it impossible otherwise to get a college education.

However, our problem goes beyond the immediate needs, and we must begin now to devise ways of stimulating interest in science and engineering among secondary school students and to find the means to provide financial help to the end that all fully qualified young men may have the opportunities of an education in engineering or science.

The future for the young man in engineering or science is indeed bright; it presents a challenge and an opportunity that we should not and cannot let pass. Educators and industrialists alike must do everything possible to encourage students at the secondary school level to study mathematics and the other basic sciences and to develop in the students an interest in a future career in one of the technical fields.

Many industrial companies in the past have been real benefactors of engineering and science with their programs to stimulate interest through awards to promising young men and young women. The Westinghouse Talent Search and the Bausch & Lomb Honorary Science Award Medal and Science Scholarships are two examples of awards which annually attract nationwide attention. Industry has sponsored postgraduate education on a broad basis for many years; an increasing number of similar awards at the undergraduate level is urgently needed to maintain the flow of the best talent into scientific fields. Such a program will prove profitable to industry and to the country alike. The Federal Government may well augment the scholarship and fellowship rograms if the recommendations made in the Bush report "Science, the Endless Frontier" are followed when the National Science Foundation is established.

Yes, the future is bright in engineering and science; the horizons are virtually limitless. Let us seize the opportunities and tackle the job aggressively.

Some of the 1946 finalists for the Bausch and Lomb Science Scholarships with Dean Wilder of the University of Rochester.

We Need More and Better Chemistry Taught to

A Serious Message Concerning a Serious Problem

Little more than a century ago when a man wanted to practice medicine, it was not unheard of for him to hire out to the neighborhood doctor, make himself generally useful including cleaning up the barn, watering and feeding the horse and driving the doctor's buggy. In return for these services, he was allowed to read the medical books in the doctor's library and assist the doctor with minor practices. In due time he was sufficiently versed in the art of medicine to step up from the position of journeyman to master and hang out his own shingle. This sort of apprenticeship system in medical education was possible because of the simplicity of medical knowledge then existant and because the practice of medicine was little more than the application of poultices and the administration of physic with an occasional use of the buckle and strap in bone cases. Today the public is fairly conscious of the vast change in the picture of medicine and many informed people are well aware of the rigors of the ten to twelve years of study required for the preparation of a physician.

TURNING to the matter of nursing education, we find a similar turn of events. A century ago America had no trained nurses. Fifty years ago when the education of nurses was in its infancy, the formal training consisted almost entirely of instruction in practical skills interspersed with occasional lectures in the evenings from members of the medical staffs. Today there is an entirely different era in nursing education much as there is in medical education. Emphasis upon practical skills is not enough in modern nursing education. The professional nurse must know the "why" as well as the "how" in order to practice the art and science of nursing with its close relationship to the science of medicine. As the wealth of scientific advance rushes upon us, nursing educators find themselves faced with a very difficult problem, that of including in our three-year basic nursing course sufficient background in the sciences that are basic to good nursing practices. Chief among these sciences is chemistry.

Chemistry teachers in nursing schools need the help of chemistry teachers in high schools in preparing pre-nursing students to make satisfactory progress in this and related fields. Most good schools of nursing require one year of high school chemistry as a prerequisite for entrance to the school of nursing, but unfortunately the majority of students come to us with very inadequate grounding in this area. Such students tell us that they did not get very much out of their high school chemistry courses and repeatedly give such reasons as, the high school did not permit pre-nursing students in the college preparatory chemistry class, or the chemistry course in the high school was planned to prepare boys for the technical colleges and the teacher was not interested in the pre-nursing students. Also, we often note on high school credentials that the pre-nursing applicant has taken a chemistry course with such a title as, "Household," "Applied," "Practical," etc. Whatever the objectives of such courses may be, one thing is quite certain and that is that in the state of New Jersey such courses have in far too many cases failed to give the student the fundamental principles of chemistry that are necessary as a background for our chemistry courses in schools of nursing.

WE FEEL in nursing education, that the high school teachers of chemistry do not understand the position of chemistry in the education of a nurse and because of this they do not know how to prepare a pre-nursing student in this subject. Chemical principles are basic to much of the nurse's education, having many interrelationships within the whole nursing curriculum. To illustrate a few instances of the importance of chemistry, let us cite a few examples from various course content as given in the nursing school curriculum. Chemistry is needed to impart a concept of the integrated function of the various systems of the body, of the constancy of the lymph in the tissue cell environment, of the chem-

t to Pre-Nursing Students in High School*

MARGARET B. ALLEN,
R. N., M. A.
Director of Education, Orange Memorial Hospital, Orange, New Jersey

istry of the blood, the work of the tissue cells in normal and abnormal metabolism, the importance of the acid-base balance, the breakdown of the nutrients in digestion, the action of drugs, of hormones, of vitamins, the importance of maintaining isotonic concentrations of the body fluids, the concentration of oxygen in the oxygen tent and a very great many other similar specific instances. Our chemistry and related science courses must include this teaching and it is not necessary to remind the teachers of high school chemistry, that in order to grasp material of such scope and caliber, the student should first be grounded in the sound elements of chemistry. By this we mean that the student should understand the basic principles of the molecular and atomic theories, simple chemical reaction expectations, be able to interpret a chemical formula, understand combining powers of elements, know what is meant by hydrolysis, oxidation,reduction, the theory of ionization and pH relationships and buffer action, to mention some specific examples. We feel that it is more important that our students be able to explain what an acid, a base, and a salt are, than to be too much concerned with the arithmetic of balancing equations.

THERE IS little doubt but that this discrepancy in preparation of the pre-nursing student has come about through lack of understanding on the part of high school educators of what we are trying to do in nursing education. There has been a tendency for many years in high schools to regard nursing as a practical vocation and as such to feel that the pre-nursing student needed little beyond a certain degree of maturity, an honesty of purpose and a strong constitution in order to enter upon her chosen field of study. Within the memory of many nurse administrators today, was the frequent instance of the referral of an unsuccessful student by a well- meaning high school principal with a kindly note to the effect that while Mary had failed to make the grade in high school, it was felt that she would be good material for the nursing school because she was honest, willing, and strong. While honesty, willingness, and physical strength are admittedly excellent qualities for any nurse, they are in this present day of science, not nearly enough. The scope and responsibilities of nursing face a continuously widening frontier. It was said recently by an eminent nurse educator, that fifty years ago a nurse was not trusted with a fever thermometer, twenty years ago a nurse was not made responsible for taking blood pressure, five years ago it was almost unheard of for a nurse to administer intravenous infusions, and so the picture constantly changes all of which means more and better preparation of our nurse students which in turn means better preparation of our pre-nurse students on the high school level.

We are convinced and hope that we can succeed in convincing you, that the high school needs to revise its attitudes in the matter of pre-nursing preparation. Such students need as careful academic preparation as do any student who is being prepared for the colleges and medical schools. Just as medical education has long since advanced from the horse and buggy era, so nursing education in order to keep pace has had to meet the demands of the on-rush of scientific achievement in a proportionate manner.

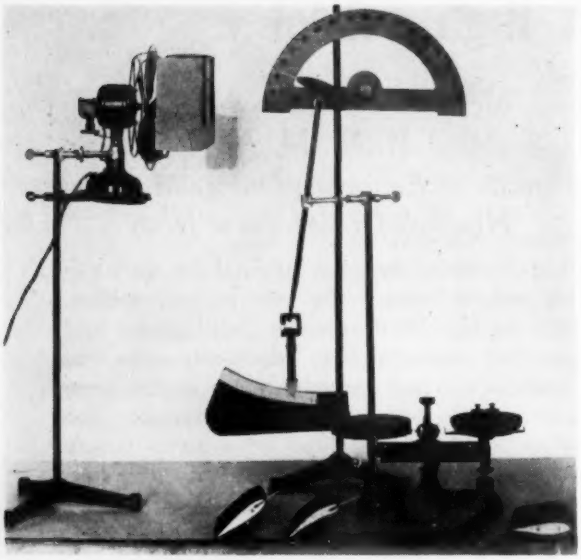
TO HELP US toward the fulfillment of our aim, you high school educators should give the pre-nursing student the best chemistry you have to offer—whether it is your college preparatory course or some other course especially planned for her. We are all potential consumers of nurse service and so, perhaps, it behooves those of us who can contribute to the education and making of nurses to do the very best jobs we can or we may find ourselves the victims of an unpleasant boomerang.

*Presented before New Jersey Science Teachers Association.

Lift and Drag

H. R. BLANCHARD

Senior High School, Keokuk, Iowa



Home-made apparatus showing fan with grill to straighten air flow. Drag is read on paper scale in grams; protractor measures angle of attack; lift is found by adjusting slide on balance.

When aeronautical engineers design an airfoil extensive experiments are carried out in wind tunnels to determine various desirable and undesirable characteristics of the wings or other airfoils.

You have probably learned from your text that, if other factors are kept constant, lift varies directly, within certain limits, with the angle of attack. In doing this experiment you will learn what factors must be kept the same and how the lift and drag are affected by a change in the angle of attack.

II—HOW TO DO IT

Set up the fan about 1 foot in front of the balances as shown in the picture. During the experiment be sure the distance from the fan to the wing model is always kept the same because varying this distance will vary the wind velocity and in this experiment we want to keep the wind velocity constant varying only the angle of attack.

Place weights on the right pan to just balance the wing. Adjust the pointer on the airfoil to the zero mark on the protractor and turn on the fan. You will note the balances become light on the left side due to the lift on the airfoil. If you balanced the system with the slide to the extreme right hand side you will find it easy to determine how much lift is produced by merely sliding the slide back to the left until the balances again balance while the fan is running. Record the amount of lift found for this angle of attack in tabular form as shown on the following graph sheet. Also read the amount of drag produced at this angle of attack and record it. Next adjust the wing so the pointer rests at five degrees *while the fan is running.* This may take a little experimenting. If you adjust the angle without the fan running you will find you no longer have the desired angle of attack after you turn on the fan. Make readings of both lift and drag at 0, 5, 10, 15, 20, and 25 degree angles of attack. Plot your data on a graph as illustrated using your own data.

III—HOW TO RECORD YOUR DATA

All data for this experiment should be recorded on the graph sheet in a manner somewhat as shown by the sample.

IV—EXPLANATION OF YOUR DATA

1. At what angle of attack does your graph show the lift to be greatest?..........

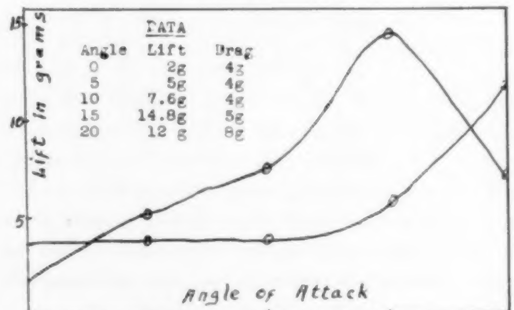
2. How do you account for the rapid decline of the graph after this angle of attack has been exceeded?..........

....

....

3. At what angle of attack would this wing stall? ....

A SAMPLE GRAPH



Simplifying the Molecular Theory

AARON GOFF

Cleveland Junior High School, Newark, New Jersey

IT IS OFTEN very annoying to be unable to give an explanation which satisfies most of the members of a class in a subject such as General Science. This difficulty, in respect to the molecular theory was quite bothersome and provoking until the following simple development was worked out.

After a discussion of the two types of evidence commonly encountered in criminal cases, concrete questions are asked the class. "If a man is seen running from a room in which a body is soon after discovered, what would you suspect?" "How could you be certain of a person's guilt?" "Does the sun shine on a cloudy day?" "What does the sound of an explosion usually mean?" "Can you know of an explosion without actually seeing it?" These questions and their answering soon clarify the difference between circumstantial or indirect evidence as opposed to direct or visual evidence.

REASONING may be carried further by making a damp mark with a sponge or cloth on a blackboard and by watching it dry. Analysis of the discussion brings out dissatisfaction with mere words, such as evaporation or "going into the air." The critical question is, "How much of the water goes off into the air at one time?" The class will soon admit that the particles of water escaping must be very tiny for this process to be invisible. Perhaps a piece of slate may be dampened and placed under a microscope to be observed during the drying period. Eventualy the class is satisfied that evaporation is the separation of very minute submicroscopic particles from the liquid. A comparison of warm and cold water on the blackboard induces the conclusion that warm particles escape and therefore move faster.

A diffusion demonstration in which crystals of copper sulphate are placed at the bottom of a graduated cylinder, which is then carefully filled with water, will show the formation of a blue layer only at the bottom. Observation of this graduate over a period of weeks will invoke a discussion which is sure to end with a molecular explanation. A similar demonstration of diffusion can be performed by releasing a strong-smelling gas, such as acetic acid or hydrogen sulphide, in a room which has windows and doors closed. Of course convection currents are always present in a room containing human beings, and this will confuse the explanation of diffusion to a certain extent.

THE MERE phenomenon of solution, of salt or sugar in water, or of alcohol in water (with shrinkage) may be used, with the help of leading questions, to bring out an explanation involving the molecular theory. The effects of various solvents, solutes, temperature and even pressure in the case of gases, usually result in broad classroom interest. A beaker full of carbonated beverage bubbling with carbon dioxide provides an interesting, familiar source of observations which fall in line with this trend of thought.

After sundry examples of this kind, the teacher may tell the story of the two metallic plates which were clamped together for several years with the result that there was some interpenetration. The students will, of course, understand that there are many similar experiments which have been performed, which are beyond the scope of the average classroom. Among the discoveries resulting from the use of the new electron microscope are what appears to be giant molecules. The abilityof gases under high pressure to pass through metal may be added as evidence of the existence of divisible particles surrounded by spaces. The penetration of light through very thin sheets of metal, and of x-rays through heavy thickneses of steel and human bodies, is evidence of a similar nature.

THESE commonly experienced or witnessed phenomena have been found to bring the molecular theory to the psychological doorstep of students' minds so that they are no longer on terra incognita and the theory begins to have meaning.

Science for Society

EDITED BY JOSEPH SINGERMAN

• A department in which science is presented in its close relationship to the individual and in which guidance is given in causing the individual to recognize the methods of science and its vast social implications.

Legislation Needed for Science Foundation and Support of Science Education

International Control of Atomic Energy Technically Possible—American Scientists Credited for Civilian Control Legislation

Atomic Energy Commission

THE PASSAGE by the last Congress of a forward looking law establishing the United States Atomic Energy Commission, in which military dominance is avoided, will prove to be a boon to the nation. It lays the basis for renewed hope for continued freedom of scientific endeavor. The President's choice of David E. Lillienthal, renowned as former Director of the Tennessee Valley Authority, as Chairman of this new commission, was hailed by all progressive forces in science, in labor and in politics. Mr. Lillienthal was chairman of the Board of Consultants for the Atcheson Committee which last March prepared the Report on the International Control of Atomic Energy that formed the basis for our foreign policy on atom control.

There are indications that removal of domestic development of atomic energy from military control has encouraged conciliatory gestures, in the international scene, toward the ultimate goal of international control of atomic energy. The now famous July 23 letter of former Commerce Secretary Henry Wallace, though it stirred somewhat of a political storm, had definitely one very good result. It stirred into open public discussion the basic issues in the way of international agreement. Wallace made it plain that both sides must be ready to make concessions. We cannot expect basic concessions from the Soviet Union while we continue to increase our stockpile of atom bombs. On the other hand, there must be assurance of dependable control to allay any fears that may provide justification for a continued armament and atom bomb race. Copies of the Wallace letter may be obtained by writing to the Independent Citizens Committee of the Arts, Sciences and Professions, 135 West 44th Street, New York City 19.

Control of Atomic Energy

THE BASIC problems of atomic energy control were surveyed by the Scientific and Technical Committee of the UN Atomic Energy Commission. In its unanimous report of September 26, the Committee concluded, "We do not find any basis in the available scientific facts for supposing that effective control is not technologically feasible." The Committee delved into every phase of the technical aspects of control through every stage of processing, beginning with the mining of the ores. The problem was approached in a scientific spirit, objectively, without emotional bias. But the Committee was not concerned with political or economic aspects of control. Therein lie the hurdles currently being encountered.

The Soviet Union, at great cost and sacrifice, has won a place of power and dignity in world affairs. They are determined to maintain that position and are sensitive to any threat, implied or actual, to the dignity of that position. The United States is no less relentless in its drive for a hard bargain on the economic and political front. One may very well wonder whether the United States State Department might be serving as a spearhead for extending monopoly control of atomic energy by American industrial in-

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terests. In that light, one can understand the Soviet fear of foreign inspection of their internal industry. The American plan, the so-called Baruch recommendation, includes international inspection. Such inspection appears to be essential to the plan.

The gyrations of our powerful organs of publicity, in playing up imagined Soviet threats, has not helped to alleviate the situation. Such activity, on the contrary, is already bringing recrimination. Unwarranted atomic diplomacy must not be permitted to culminate in developments that might bring regret. The politicians might well take a cue from the scientific method of approach followed by the Lillienthal committee. Mutual understanding and reciprocal yielding are essential to arriving at basic agreements in this vital problem. There are, to be sure, unmistakable signs of progress in this direction.

There is every indication that we can meet the Soviet Union on plans for suitable international control of atomic energy. I choose to be optimistic that the two great powers will agree. We must agree for survival. I am optimistic because neither wants war or needs war. I am optimistic because both nations have much in common. I am optimistic because there is much to be gained, mutually, by peaceful intercourse.

WHAT MAY be feared, in the unhappy delay in reaching agreement on international control of atomic energy, is the less publicized threat of biological warfare methods. Biological warfare research, preparation for such warfare, and the launching of aggression by such methods can be carried on more cheaply, and can be more easily concealed, than can nuclear research and development. Biological warfare can be as devastating as atomic warfare. Our channels of publicity continually harp on their own filtered version of current negotiations for atomic energy control. But the public is, in the main, not aroused by suggestions that biological warfare preparations may be carried out in one or two of the remaining Fascist nations. Agreement on control of atomic energy to prevent its possible use for war would lay the pattern for control also of biological warfare. Early atomic agreement would insure also early control of biological warfare.

Civilian Control Legislation

To American scientists goes credit for preventing enactment of shortsighted domestic legislation. As a result of their indefatigable efforts, the recent Congress passed legislation for civilian control of atomic energy, free from military domination. The scientists achieved success by presenting the facts. They informed Congressional committees of the nature of atomic energy, of its potentialities for either benefit or disaster. They informed the public, and received the support of people nationwide.

For those who want to keep informed on this most pressing technological—social—economic—political problem in the world's history, the National Committee on Atomic Information offers up-to-date authoritative information on developments in this field. They provide pamphlets, study guides, program materials and bulletins, some free and some at low cost. Their address is 1749 L Street, NW, Washington 6, D. C.

Science Foundation and Support of Science Education

THE RECENT Congress failed to pass a Science Foundation Bill, although a good compromise, the Kilgore-Magnuson Bill, had wide support. A new bill will undoubtedly be introduced in the forthcoming Congress. But indications are that it will require even greater effort on the part of science teachers in cooperation with scientists, labor and progressive organizations to shape it into desirable form. Senator Warren G. Magnuson, co-author of the above mentioned bill, urges that science teachers direct their efforts toward keeping posted on coming legislative proposals and make their wishes known to their own Congressional representatives.

Also watch for reintroduction and maturation of legislation for Federal support of science education in secondary schools as well as equalization of educational opportunities. In the latter category there will undoubtedly

Continued on Page 91

Science Clubs at Work

Edited by DR. ANNA A. SCHNIEB

State Teachers College — Richmond, Kentucky

• A department devoted to the recognition of the splendid work being done by the science club members and their sponsors in the various State Junior Academies of Science. Material for this department, such as student made projects; demonstrations and posters; outstanding club programs; state and regional meeting announcements; should be sent to Dr. Schnieb.

The Rhode Island State Science Fair—1946

By J. HERBERT WARD and R. K. CARLETON

A NEW AGE, The Atomic, was ushered in with the dropping of the atomic bomb on Hiroshima about a year ago. With the application of the atomic bomb however, came the knowledge that the man-power to utilize the power of the bomb is lacking. Unfortunately, the United States did not keep its scientists at home during the war that has just ended, as was true in the European countries. As a result, thousands of young men and women must be trained at once, in order to reap the benefits that will come if this nation is to use to the utmost this new found power for social progress.

During the past years, a number of the secondary school science teachers in Rhode Island have been cooperating with Science Service in order to find capable young people who were outstanding in scientific achievements. It was felt that somehow this did not enable many of them to begin soon enough to develop their talents in that field. Some other type of competition might serve better to achieve the purpose. The idea of a State Science Fair was proposed. This was to be participated in by students from schools all over the State.

Development Plans

Originally a committee of secondary school science teachers was appointed to encourage participation of high school people in the Westinghouse Science Talent Search. There were five members of this committee. Three were asked to search out the possibilities of having a State Science Fair. When the Institute of Instruction met in Providence in the fall of 1946, Mr. Watson Davis, Director of Science Service, was asked to speak to the Science Section. During his brief visit to Providence, however Mr. Davis together with the committee members paid a visit to the Providence Journal Company, publishers of the Providence Journal and Evening Bulletin. Through the successful efforts of this solicitation, the newspaper company agreed to sponsor the project and made available for the use of the committee a generous sum of money.

Publicity started in the late Fall with the appearance in the school section of the Sunday Providence Journal of an article announcing the project, together with the names of committee members and the general plans of the Science Fair. This policy was continued for several weeks until along in the early Spring of 1946 short articles relating to the coming Fair began appearing in the daily issues of the paper. This was followed at more frequent intervals by photographs of some of the young men and women who were developing displays to put on exhibition. The publicity continued to increase in intensity until time for the Fair to start. The Committee feels a sense of gratitude for the splendid way in which the Providence Journal helped to insure the success of the Fair.

ON THE Saturday preceding the formal opening of the Fair, all exhibits had to be set up. The school cafeteria was opened at 9:00 o'clock on the morning of Saturday, April 6th, and by 5:00 P. M. that day, more than 300 exhibits had been put in order. Arrangements had been made for any who had animals on display such as birds or mice to enter the building Sunday to care for them. Otherwise the building was closed to all visitors that day. On Monday the displays were examined

A scene at the registration desk. (Courtesy of Providence Sunday Journal)

by the judges. The group of judges worked from 2:00 P. M. until near 6:00 o'clock in order to complete their task. The winners were divided into three general groups, namely, (1) First Grant, or those eligible to possible scholarship awards; (2) Second Grant, or those who would receive subscriptions to magazines; (3) Third Grant or Honorable Mention. As far as possible yellow cards indicating First Grant were placed in front of each winner of that class prior to the official opening of the Fair that evening.

At 7:30 P. M. that evening the public was invited to listen to an address by Dr. Harlow Shapley of Harvard University before viewing the exhibits. The title of his address was "Science The World Over" which he presented in a most interesting and instructive manner. The meeting was held in the auditorium of the Hope High School and more than 1,000 persons were in attendance. Following Dr. Shapley's address the Fair was declared officially open to the public and the large audience went downstairs to view the exhibits. It was kept open until 10:00 P. M. Next evening the program was carried out in a similar manner except that an address entitled "An Astronomer Looks at the Atomic Bomb" was presented by Dr. Charles H. Smiley, Director of the Ladd Observatory at Brown University. Dr. Smiley discussed the rather difficult subject in a fascinating manner and it was enjoyed by everyone. He admitted that this was a rather difficult task since he was aware that there was an age range amongst his hearers of from 6 to 60 or even more.

The program on the following two evenings was carried on in a similar manner except that movies of Science subjects were shown in place of an outside speaker. The audiences were large each evening. The public was not permitted to view the exhibits until the formal program in the auditorium was completed. The last evening was devoted largely to the awarding of gold keys and certificates to the First Grant winners. Dr. James M. Rockett, State Director of Education, made these awards. The Fair closed officially on this evening (Thursday) and by evening of the next day all exhibits had been dismantled and removed from the building. It was a source of satisfaction that everything connected with the setting up and dismantling of the exhibits was carried out without a hitch and with much dispatch.

The exhibits were distributed as follows amongst the five divisions, viz.,

Type	*Number*
Mathematics	0
Biological	96
Physical Science	147
Engineering	75
Public Welfare	20

Criteria and Procedure of Judging

There were nine criteria to be used by the judges in arriving at their estimates of the value of an exhibit. They were:

1. *Uniqueness of Concept.* The idea should be original, commensurate with the age level of the exhibitor.
2. *Originality of Execution.* There should be originality in the use of common, everyday material utilized in the execution of a scientific principle.
3. *Scientific Thought.* The exhibit should demonstrate the result of analysis, experimentation, observation and verification in the solution of a clearly defined scientific problem.
4. *Thoroughness.* The exhibit should carry out its purpose to completion within the scope of the problem or idea.
5. *Technical Skill.* The exhibit should show a degree of perfection of workmanship in the media used in the execution of the idea or problem.
6. *Dramatic Value.* The exhibit should be dynamic and graphic. It should convey its meaning intrinsically with a minimum of signs and detail.
7. *Social Implications.* Evidence should be shown of the awareness on the part of the exhibitor or exhibitors of the relationship of the exhibit to the welfare of man.
8. *Timeliness.* The exhibit should be of current scientific interest.
9. *Advancement of Science.* The exhibit should incorporate some aspect of the advancement of pure science.

Each exhibit was judged on its own merits without competing against any other exhibit. The judges used the Criteria for Judging as listed above, and gave consideration to the *degree* in which these standards were met. Each of the nine Criteria for Judging had a maximum value of ten points. The judges evaluated each exhibit on a point basis. Each exhibit was awarded a Grant, the amount of which was determined by the number of points earned by the exhibit as follows:

First Science Grant. Awarded to each exhibitor whose exhibit earned a sufficient number of points to place it within the first quarter of all exhibits in its same class in the Junior and Senior groupings.

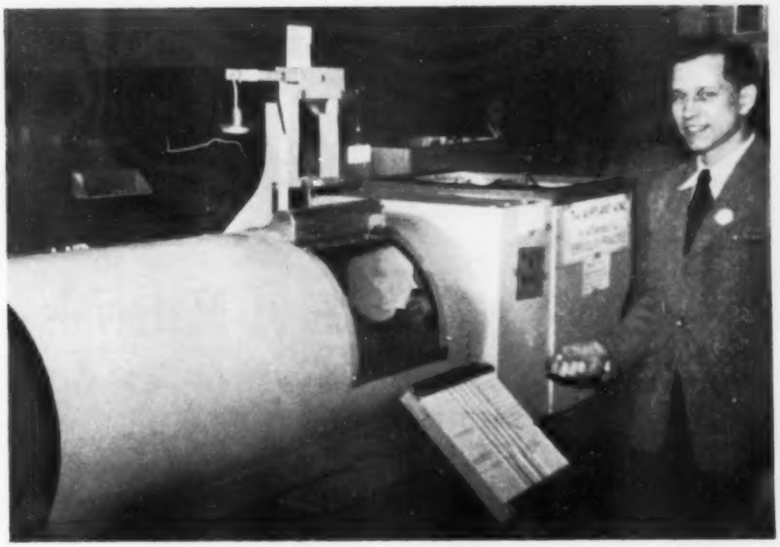
Second Science Grant. Awarded to each exhibitor whose exhibit earned a sufficient number of points to place it within the second quarter of all exhibits in its same class in the Junior and Senior groupings.

Third Science Grant. Awarded to each exhibitor whose exhibit earned a sufficient number of points to place it within the third quarter of all exhibits in its class in the Junior and Senior groupings.

Awards

THOSE senior students whose exhibits rated a First Science Grant were eligible to take an examination which was given on a Saturday as soon after the close of the Fair as was convenient. It was held on May 29, at Central High School in Providence. As a result of this competitive examination five scholarships were awarded. These had all been made available by the five institutions of higher learning in the State, namely, Brown Univer-

Taking their high tension apparatus into the exhibit building. *(Courtesy Providence Sunday Journal)*



A wind tunnel and the youn; man who built it.
(Courtesy of Providence Sunday Journal)

sity, Pembroke College, Providence College, Rhode Island School of Design and Rhode Island State College. With the exception of the last named institution, these scholarships covered tuition for a halfyear at each institution, amounting respectively to $225 in the case of the first two schools, $150 for the third and $200 for the School of Design. For the State College the scholarship amounted to $140 which covered college fees for one year.

Other awards were also available to the students who ranked highest in the competition. These awards were made available by different organizations in the project and were as follows:

1. Slide rule and Chemistry Handbook. Given by the Rhode Island Section of the American Chemical Society.
2. Scientific equipment of journals to the value of $5.00. Made available by the Lincold School (Limited to girl winner.)
3. Scientific equipment of journals to the value of $10.00. Given by the New England Association of Chemistry Teachers.
4. Gold Medals. Given by the Providence Journal Company.
5. Twenty-five science magazine subscriptions. Made available by Science Service, Inc., Washington, D. C.

Conclusion

THE SCIENCE Fair for 1946 is now history. There is no question but that it proved to be a much greater success than anyone could have predicted.

Quoting a recent statement by Watson Davis, Director of Science Service, Inc., he says,

> "The Rhode Island Schools' Science Fair, organized by the teachers of Rhode Island's secondary schools and supported by the Providence Journal Company, is a major step in science education and public appreciation of science in the community. Reviewing the past four years, who can dispute the statement that America's most precious resource is the scientific ability of its youth? If we stimulate the inquiring minds of boys and girls who are gifted along scientific lines—if we give them an opportunity to build a foundation of scientific knowledge—and if we supply the incentive and the means for them to experiment for themselves, then they will continuously remake our civilization and assure our progress that is based on science . . ."

Is any further justification needed for sponsoring and carrying on such a project than these words just quoted? It is trite to say that the war made tremendous inroads upon the scientific reserves of this country. The damage cannot be repaired for many years to come. It is necessary then that America treasure, protect and encourage the coming generations of scientists if this country is to adequately meet the staggering scientific problems that lie immediately ahead and maintain a leadership in the world of Tomorrow.

Audio-Visual Aids

EDITED BY CHARLES R. CRAKES

The editor of this department will attempt to bring before the readers of this publication the latest articles written by science teachers who are making effective use of various forms of audio-visual teaching materials. He will also endeavor to present a cross-section of educational opinions on audio-visual aids he may gather in travelling about North America.

Sources of Materials

CHARLES R. CRAKES

TO YOU science teachers interested in selecting effective audio-visual teaching materials, the editor offers the following suggestions on source of materials.

The *Educational Film Guide* compiled by Dorothy E. Cook and Eva Rahbek-Smith, and published by H. W. Wilson Company, New York City, contains the most complete listing of class room teaching films of any similar publication in America. The Guide comes out in one large volume and four supplements each year. At the present time only films are listed. All films are listed under the regular Library Dewey Decimal System, as well as under specific subject matter areas and topics. Each film is identified by name, production date, time to run, type (black and white, colored, sound or silent), purchase price and several rental sources. The film is evaluated by a group of collaborators and listed as suitable for primary, elementary, junior high school, senior high school, college, trade or adult groups. A brief description is given of film and occasionally special comments made by a collaborator or user, are included. A subscription price of $3.00 per year is charged for these publications.

Two excellent magazines devoted to the audio-visual field should be made available to all science teachers. *The Educational Screen Magazine* published monthly, except July and August at 64 East Lake Street, Chicago, Illinois (subscription price $3.00 per year), devotes its pages to articles dealing with the many and varied problems connected with the effective use of audio-visual materials. The actual using of audio-visual aids by the class room teacher is given first consideration by this publication. Departments devoted to the Curriculum Clinic, School Made Audio-Visual materials, Literature in Visual instruction, Church Department, Equipment, Experimental Research in Audio-Visual Education, Audio-Visual Trade Review, News and Notes, and Current Film News, are some of the features of interest to the users of audio-visual materials.

SCIENCE teachers will be particularly interested in two articles in the October, 1946 issue—"Let Your Pupils See Science," by Mary Jane McClary, Public Schools, Brooklyn, N. Y., and the review of an experimental research project "An Evaluation of Selected Instructional Films in Science," by Oreon Keeslar, Director of Audio-Visual Department, Kern County Schools, Bakersfield, California.

The second publication, *See And Hear Magazine*, published by Audio-Visual Publications, 157 East Erie Street, Chicago, Ill., (subscription price $2.00 per year), devotes its energies to problems relating to all phases of the audio-visual movement. The editor of this publication is primarily interested in those "Curriculum Subject Matters Areas which comprise the broad classification into which formal education, particularly at the high school and college level, has allowed itself to be categorized."

One feature of special interest to the science teacher is *The Inventory of New Material*, which contains many new teaching aids for the class-room, and a reader reply form for such material. Special attention is also given to educational radio programs. The articles are well illustrated and are most vitalizing as to content.

WITH THESE three publications in the school library, you will have ready access to listings and sources of films and other materials required by your classes. You may also keep abreast of all new developments within the audio-visual field. The audio-visual movement is tremendous in its scope and power and alert teachers will constantly endeavor to make more effective use of all forms of these vitalized and essential teaching materials.

In reply to several inquiries concerning effective techniques of using motion pictures in the class room, your editor offers the following article on "Utilizing Science Films," written by Norma A. Barts, a specialist in the field of film utilization.

You are again reminded that the readers of the *Science Teacher* are most interested in learning how fellow teachers make effective use of any form of audio-visual teaching material. Send in your articles as suggested in the October issue. Your questions will also be given prompt attention.

Utilizing Science Films

NORMA A. BARTS
Visual Aids Counselor,
DeVry Corporation

MERELY showing a film in a science classroom is not enough. An old Chinese proverb says that "A picture is worth a thousand listens." Yes, a picture may give a first-hand, clear-cut, accurate and meaningful impression of a concept or law or development in science *if* it is interpreted and understood correctly. We need to overcome excessive verbalism in our science program by presenting more varied and more vivid learning experiences, but, as M. R. Brunstetter has remarked, "Merely observing a film does not constitute or provide the entire learning which is to be expected."

The projecting of science films will be ineffective unless the teacher in charge uses as much if not greater skill than he or she would utilize with other teaching devices. Some simple statements are needed to guide the science instructor. Here are a few direct and brief suggestions to help the classroom teacher use films in teaching situations:

Preliminary Considerations

1. Use films to supplement, not to substitute for the teacher or reading assignments.
2. Actually teach the material portrayed in the film; do not just display the film or use it only to pass the time away.
3. Don't use a film to arouse interest in a topic and then neglect the interest which has been aroused.
4. Don't use films if you believe they will save you time and thought and work. They won't—if you want them to contribute to your teaching of science or if you want students to gain the objectives of the science curriculum.
5. Employ the film as your servant, not your master.
6. Remember that the procedure by which a motion picture is utilized may vary. A film may be used at different times for entirely different purposes, and different activities and emphasis may be more effective at one time than at another.
7. Maintain a normal classroom atmosphere: dispel the idea that films are a "treat" or that you are putting on a show. Employ quick and simple, unobtrusive methods to prepare for showing the film.
8. Present the film to one class only with the regular science classroom teacher in charge.

Selecting the Teaching Film

1. Since the film is to be an integral part of the classroom work, the contents of it must correlate with the subject matter being studied at that time.
2. It is most important that you meet the age and maturity level of your students, and not submerge them, with the contents of the motion picture. Compare the film material with the pupils' previous experiences.
3. The length of the film will help determine its educational value. The younger your students are, the less complex the composition of the film should be and the shorter

it should be. Always limit the presentation to one reel.

4. Apply each motion picture to its own situation. Do not compare films. The question is not whether a film is good, but is it a good film for a particular purpose, for a particular group of pupils, and for a particular set of circumstances.

Planning the Science Lesson

1. Preview the film in order to be familiar with what it does and does not contain.
2. Determine your purposes for showing the film. Then plan the lesson as you would plan any other good science lesson.
3. Don't include too many visual aids in one lesson plan.
4. Read any material that may accompany the film. These suggestions may prove helpful to you and to your students.
5. To prepare for projecting the film, follow the procedures set up by your administrator to secure a projection room, equipment, and student operator.

Pre-Showing Preparation of the Science Class

1. Pupils must be prepared in advance for the contents of the film. The teacher should aid students to understand the purposes for studying the topic. Students must know what they will see and why they are seeing this science film.
2. This can be done in any number of ways, including
   a. group discussion
   b. questions and answers
   c. blackboard outlines or notations
   d. vocabulary enrichment exercises
   e. lecture
   f. references to past experiences
   g. utilization of other teaching aids—books and concrete visual materials
   h. laboratory work.
3. Whatever method or methods you employ to introduce the lesson, be sure that you challenge the students to THINK.

Projecting the Science Film

Remember that you are using a film because it depicts motion. Do not hinder the continuity of action by stopping the motion picture or by reversing it to emphasize a still picture. If you feel a need in your science lesson for prolonged discussion or detailed study of projected materials, plan to use still projected aids, slides, a filmstrip, etc.) the following day.

Post-Showing Activities

1. After projecting the film, lead the class back to a consideration of the purposes for viewing it. Complete the activities started before the film was shown. This again may be accomplished in a number of ways:
   a. questions and answers
   b. discussions
   c. oral reports
   d. reading from reference materials and texts
   e. use of blackboard
   f. written reviews
   g. notes, outlines, etc.
   h. laboratory procedures
   i. field trip
   j. dramatizations
   k. creative writing, drawing, modeling, etc.
   l. use of other audio-visual aids.
2. Avoid aimless discussions or activities.
3. In order to clear up misunderstandings or in order to review the material again, the film may be shown a second and a third time. For the second showing of the motion picture it is sometimes wise to point out, explain, or emphasize particular parts of the film. A science instructor may even desire to run a sound film as a silent one; you, the teacher, or your pupils may then speak during the showing of the film, discussing or questioning the activities depicted upon the screen.

Coordinating the Film Lesson with Other Objectives

1. Raise new problems, alter old ones or set new purposes for the science class as these result from seeing the film. Allow these discussions to be teacher-directed, not teacher-dominated.
2. Evaluate the science film in its relation to the whole learning situation. Ease the class into a discussion which will encourage free and spontaneous student reactions. Use these reactions as indices to aid you to plan the next lesson with a film more effectively than you planned this lesson.

Continued on Page 91

The Importance of Science for the First Nine Grades

EDITH C. VEAZIE
Mason Junior High School,
Tacoma, Washington

Many articles have been written to show the desirability of a well-rounded course in science, beginning with the first grade and continuing through high school. The question is—What can be done to bring it about?

An inadequate science program in our schools at the present time can be blamed upon the colleges, which do not offer an efficient course of scientific training for the elementary and junior high teachers; the superintendents who do not rightly place their teachers; and the authors of text-books which are unattractive and difficult to use in the class-room.

At the present time there are on the market several series of very attractive science readers for the elementary grades. Even when the books are available, the entire emphasis is often placed on teaching the child to read rather than to develop in him an awareness of his surroundings, because many teachers have had little or no scientific training and have no genuine interest in the subject. In Tacoma, the Science Curriculum Committe, encouraged by the superintendent of schools, published a pamphlet containing keys to the local flora and fauna, shells and minerals, which was given to each grade and junior high teacher. To stimulate interest and supplement the information in the above pamphlet, a series of lectures was presented by authorities in the various fields. Despite good attendance, the low percentage of elementary teachers present showed the need for further efforts.

There is great difficulty in securing adequately trained teachers in localities where there are junior high schools in which general science is taught for from one to three years. If the teacher is, by chance, a science rather than an English or Latin major, he has a tendency to emphasize that particular branch in which he specialized, and to neglect the other fields. I know of one general science teacher who spends a large part of the year teaching the unit on electricity in a school where electricity is a required course for all boys. Unless there is a science supervisor this specialization results in a wide variance in subject matter so that it is difficult to maintain uniformity.

During the next few years it should be the chief concern of scientists and educators to concentrate on science teaching in the first nine grades of school in order to provide for the thousands of boys and girls who never reach high school or who do not plan to go to college. In schools having eight elementary grades and four years of high school, there should be an increased emphasis on science in the eighth grade and a well-rounded course in general science in the ninth. Where there are junior high schools it is preferable to have general science in the seventh, eighth and ninth grades because it is not possible to adequately cover existing material in one year.

In order that the program may be as wide and varied as possible it is necessary that the text books refrain from over-emphasizing such branches as chemistry and physics. In a questionnaire used in my classes, the subjects listed in order of preference were astronomy, geology, changes in the earth's surface (heredity and evolution), botany, matter and energy, time and direction, weather and climate, air (including airplanes), water and its uses. Because of lack of time in a one-year course presented to pupils with little or no scientific background, units such as hygiene, machines and electricity, which are partially duplicated in other departments, had to be omitted.

In one of the very fine articles in the 1945 Year Book* it was suggested that all elementary teachers include in their college preparation minimum courses in botany, zoology, physiology (or biology), chemistry, physics, geology, astronomy and a course in the methods of teaching. It would seem that this places too great a stress on science. Would not a required one-year course in general science be more suitable in a well-balanced program for the prospective teacher? Such

Continued on Page 91

This and That

NORMAN R. D. JONES
Vice-President and Membership Chairman

J. Howard Williamson, Colorado State Director, served on the faculty of the University of Colorado this past summer.

Miss Greta Oppe, Southern Area Vice-president, Jack Hudspeth, and the Texas Directors, Dr. Amy La Vesconte,and Dr. Grady P. Parker conducted a panel discussion concerning N.S.T.A. at their Texas Association meeting on November 29th.

Miss Ernestine Long of Normandy, Missouri High School and the writer of this column were speakers at the Missouri Science Teachers Association meeting on November 8th in Kansas City, Missouri.

It is now Doctor John G. Read, for our Rhode Island State Director, as he completed the work for this degree this past year. He is also in charge of the fine Science Fair put on in Providence.

Mr. Richard D. Huxley, formerly Minnesota Director, is now teaching in Honolulu, Hawaii.

Mr. James A. Keech, Vermont State Director, served as chairman of a very successful meeting of the Secondary Science Section of the Vermont Educational Association.

Mrs. Mary M. Hawkes of Hood River, Oregon, enclosed memberships for the Science Section of that district, stating that with these memberships all present were N.S.T.A. members. This is a fine 100% record.

Mr. Alvin L. McLendon Jr., Georgia State Director, was appointed to direct the various District Science Meetings of the State.

Mrs. Nadine Dungan served as Chairman of Exhibits for the Illinois Junior Academy of Science this past year.

Dr. Adams Honored

One of our members, Dr. Roger Adams of the Department of Chemistry at the University of Illinois, received the following honors this past year: "The Davy Medal of the Royal Society of London; The Theodore Williams Richards Medal of the Northeastern Section of the Chemical Society; The Priestly Medal, and was selected to give the first Remsen Memorial Lecture at John's Hopkins University."

100 Per Cent Schools

Honors go to Mr. J. H. Biebel of the Hanley Junior High School, University City, Missouri, for again securing 100 per cent membership in his school.

Miss Greta Oppe reports her Ball High of Galveston, Texas as 100 per cent.

Mr. A. J. Conrey, State Director of Laramie, Wyoming, again reports 100 per cent for his school. In addition he was honored by sending the membership of his son, Lawrence A. Conrey, now located in Michigan.

In-Service Training

Mr. Stanley E. Williamson of Oregon State College at Corvallis recently sent in a fine list of new members resulting from the work that he is directing in connection with the State In-Service Teacher Training Program. He has been in 6 counties (by the last of October) and expects to be in most counties of the state before the school year closes. Thus he will have personal contact with almost all science teachers in the state. He reports that these fine teachers are extremely interested in N.S.T.A. activities.

Science Talent Search

It is hoped that our teachers have secured many entries in the "Search" for talented youth. Tennessee under the leadership of Mr. Jacob W. Shapiro, a N.S.T.A. director, has inaugurated a "Search" of its own, following the completion of its entries into the National Science Talent Search. Many of the universities and colleges of the state are furnishing scholarships for the winners of the "State Search." This would be a worthwhile project for other states to undertake.

Membership Campaign

Our Membership campaign is progressing very nicely. We are far short of the number of members that N.S.T.A. should have. *Have you secured any new members?* If not, please lend a helping hand. If so, see if you can secure more.

Recent meetings have been very good

sources of membership as indicated by the 55 reported from Arkansas, 39 from Buffalo area in New York, New Jersey 11, Nebraska 15, Missouri 56, Central Ohio 18, 24 from Long Island, New York area, Minnesota 33.

Hawaii Membership

Mrs. Lenora N. Bilger of the University of Hawaii has recently sent in 30 memberships. A hearty welcome is extended to this fine group. It is hoped that this relationship will prove as mutually beneficial as has our Puerto Rico, British and the many other countries represented on our membership rolls.

New Directors

Miss Esther Scott, John Eaton Elementary School, 34th and Lowell St., Washington 16, D. C.

Mr. E. C. Stroud, 3925 Cornell St., Des Moines, Iowa.

Mr. J. A. Stolar, 1717 C. Ave. N. W., Cedar Rapids, Iowa.

Mr. W. E. Simpson, 731 South 9, Salina, Kansas.

Mr. Robert P. Kerr, 535 So. 2nd St., Apt. No. 6, Louisville 2, Kentucky.

Dr. George J. Skewes, State Teachers College, St. Cloud, Minnesota.

Miss Ruth Sneed, 3352 47th Ave. So., Minneapolis 6, Minnesota.

Meteor Display

Mr. A. Ralph Boxell of Clinton, Missouri, took his science classes out to observe the meteor displays. They sent in a detailed report to the Flower Astronomical Observatory. These classes prize very highly the letter that the Conservatory sent to them congratulating them on the accuracy of their observations and report made of them.

Deceased

Dr. Fay N. Pierce of Linderhurst, New York, died May 28, 1946.

Words of Commendation

TO MEMBERSHIP SERVICE: Dr. F. C. Jean of the Colorado State College at Greeley sent in his renewal, saying: I want to take this opportunity to thank N.S.T.A. for the fine service it is rendering its members. Although I have copies of some of the addresses and heard several over the radio, it is a great advantage to have them together in the one single bound folder, "Serving Through Science," as you sent them to us.

Our Membership Service Committee recently sent "Plastics" to you, and additional materials of value are being checked to send to you.

TO OUR LOYAL CO-WORKER: Mr. Cyrus E. Beckey of the State Teachers College of Kutztown, Pennsylvania, recently wrote: I spoke to a group of science teachers at the meeting of the Berks County Institute. During the business session, the secretary very ably presented the cause of N.S.T.A.

Such complimentary remarks only take a few minutes of time, yet they mean so much to all concerned.

These are typical of the many remarks which have been made. All are appreciated.

If you have news items of general interest, we will be glad to receive them.

Science Leaders Institute

The Science Leaders' Institute for the North Central Area was held in Chicago, Saturday, November 9th. Leaders from all 12 states were present. Approximately 100 additional were in attendance at the afternoon session at which Dr. Morris Meister, N.S.T.A. president, ably discussed "The Plight of the Science Teacher."

The Eastern Area Institute will be held in Boston Sunday, December 29th in connection with our meetings at the A.A.A.S. Convention. Anyone present in Boston is cordially invited to attend this "Institute."

N. S. T. A. CONSTITUTION

To correct an error in the printing of the revision of the National Science Teachers Association Constitution in the October issue, Article III. Section 1 is again presented. Portions to be deleted, if later approved, are enclosed in parenthesis and additions are printed in *italics*.

"Article III, Section 1. The officers of the N.S.T.A. shall be a president, (two) *a* general *vice-president*, (and) four regional vice-presidents, a (corresponding secretary, a recording) secretary, and a treasurer."

News and Announcements

DR. ALEXANDER JOSEPH

Dr. Joseph, the new Editor of our Aviation Department, is a teacher of General Science and Aviation at the Bronx High School of Science. He was trained in the New York City Public School system and at the College of the City of New York. He received his Doctor's Degree from New York University in 1941. His dissertation is entitled, "A Source Book of Extra-Curricular Activities in Physical Science for Senior High Schools." During the past fifteen years, he has taught science in elementary schools, junior and senior high schools and in teacher-training colleges.

He has been active in science education, having been a member of numerous Committees, one of the most important of which was the committee which developed the syllabus in general science for New York City public schools. In this connection, he has written a series of textbooks in General Science, published by Winston and widely used throughout the country. He is Past-President of the General Science Teachers Association of New York City.

Early in the War, he was selected by Professor Paul Mort to serve among the group of authors which wrote the outstanding work entitled. "Science of Pre-Flight Aeronautics for High Schools." When the War Department developed its pre-induction courses, Dr. Joseph wrote the book "Fundamentals in Mechanics," published by Scribners. In 1943, he entered the military service in the Air Corps. The Army put his experience and talents to use at once at the Turner Air Field in Georgia where he developed courses for the training of student pilots. Also, he supervised the training of the French Squadron which carried on its training at Turner Field. On November 8, 1946 at Mitchell Field, Long Island, the Legion of Merit Medal for the superb services rendered our Goxernment during the War, was awarded to Captain Joseph.

We are indeed fortunate in having Dr. Joseph with us in charge of Aviation Teaching in the columns of The Science Teacher.

SCIENCE TEACHING PACKETS

As an outgrowth of the Wise report on specifications for commercial supplementary teaching materials for science, a special committee was appointed for applying the specifications to a large number of commercial materials. The Committee consists of Dr. Johnson, Chairman, Dr. Obourn, Mr. Russell, Mr. Weaver, Dr. Wise, Mr. Hogg, Miss Burgess and Dr. Meister. Miss Bertha E. Slye was selected as executive-secretary of the Committee and has been at work on a full-time basis since October 6. Hundreds of business concerns were selected for materials. A rating scale has been developed. The scale is now being applied to these materials. The pamphlets, reprints and radio scripts which are found to be of greatest usefulness to science classroom teaching will be organized into science teaching packets for distribution to NSTA members. Miss Slye will present her report on this project at the Boston meetings. A fuller account of this activity will appear in a later issue.

COMMITTEE ON BASIC ISSUES

The General Electric Company has made a grain-in-aid to NSTA for the purpose of studying methods of improving science instruction in New York State. In line with the policy of the NSTA to encourage and strengthen the efforts of local and regional science teachers groups, this grant-in-aid has been placed at the disposal of the New York State Science Teachers Association and the New York City Federation of Science Teachers Association. The Committee in charge of this study consists of: Dr. Paul Brandwein, Chairman, Donald Kumro, Carleton Moose, Theodore Shull and Zachariah Subarsky. The Committee is now at work developing a questionnaire and other contributing studies that will form the basis for state-wide discussion during the coming months.

It is hoped that as a result of this work, similar studies will be undertaken in other states through additional grants-in-aid.

The Boston Program of the NSTA

AS AN AFFILIATE of the AAAS, the NSTA has welcomed with enthusiasm the opportunity to meet with the scientists of the nation at their annual convention in Boston next Christmas. NSTA was fortunate in being welcomed by the New England Association of Chemistry Teachers who appointed an excellent and able Host Committee consisting of Elbert C. Weaver, Chairman, Helen Crawley, James W. Dyson, Leo J. Fitzpatrick and Ralph E. Keirstead.

The AAAS honored the NSTA by appointing its President chairman of a special committee on Junior Scientists Assembly. This Committee has arranged a unique program of papers, talks and discussions by junior scientists, who are members of Junior Academies of Science, winners of the Science Talent Search and recent members of School Science Clubs. Participants in this program will come from many parts of the country. The theme of the meeting will be: "The Young Scientist Looks at Education and At his Work." The details of this program are in the hands of Dr. Herbert S. Zim.

Two meetings of the Cooperative Committee on Science Teaching of the AAAS have been dovetailed into the NSTA program. The first of these will include important papers on Science Counseling in Secondary Schools by Dr. Lefler, Certification of Science Teachers by Dr. Lark-Horovitz and The Crisis in Science Teaching by Dr. Schorling. The second of these meetings will be a Forum on Problems of the Science Teacher and will be in hands of a panel with Professor A. J. Carlson as moderator. Participants in the panel will be Dr. Quill, Dr. Meister, Dr. Schorling and Dr. Lark-Horovitz.

Saturday morning, December 28, will be devoted to section meetings; one for physics teachers, one for chemistry teachers, one for general science teachers and one for teachers of biology. Important papers will be presented at each of these meetings by both scientists and skillful science-classroom practitioners.

THE ANNUAL science luncheon will be held at the Hotel Statler on Saturday, December 28 with Dr. Otis W. Caldwell presiding. President Conant of Harvard University will be the speaker. We expect greetings also from the President-Elect of the AAAS. We will have as guests, members of the Executive Committee of the AAAS and the participants in the Junior Scientists Assembly.

On Saturday afternoon, December 28, about twenty New England Science teachers will come with their pupils to the Massachusetts College of Pharmacy. The pupils will present an exhibit of their science projects.

Sunday afternoon, December 29, will be devoted to a Scinece Leaders Institute of the Eastern local and area Directors of the NSTA. The program is in charge of Norman R. D. Jones, Vice-President of the NSTA.

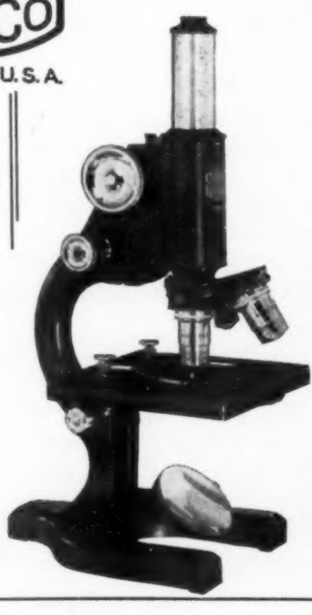
Monday morning, December 30, will provide an opportunity for Dr. Sollberger to present the 1946 NSTA Yearbook: "Time for Science Teaching," and for Miss Slye to present the Science Teaching Packet project, a service to NSTA membership. These presentations will be followed by three section meetings, one in physics, one in chemistry and one in general science. Teachers in the Boston Secondary Schools will develop the theme "Difficulties and Demonstrations" for each of the high school sciences.

The session will close on Monday afternoon, December 30, with a comprehensive exhibit of teaching materials from industry. The exhiibt will cover two floors in the Massachusetts College of Pharmacy.

A brief business meeting of the membership will be held on Saturday morning for the purpose of considering the proposed changes in the Constitution, and meetings of the Board of Directors of the NSTA are scheduled for Saturday evening and Sunday morning. A schedule of times, places and other details will be found elsewhere in this issue and the printed program will be in the hands of the membership early in December.

THE JUNIOR SCIENTISTS ASSEMBLY

THE A. A. A. S. has recently appointed a Committee on Junior Scientists' Assembly with Dr. Morris Meister, President of the National Association of Science Teachers, as



Chairman. The members of the Committee include Miss Margaret Patterson, representing the Science Clubs of America; Miss Mary Creager, representing Junior Academies of Science; Mr. J. H. Ward, representing science teachers and club sponsors; Dr. H. C. Muldoon, representing college science teaching; Dr. J. W. Thomson, representing state universities and state science clubs; and Dr. Otis W. Caldwell, representing the A. A. A. S. The Committee is working to bring together young scientists, who are still in the midst of their scientific training, so that they may share their experiences and opinions. The Assembly of Junior Scientists was planned in realization of the increasing importance of the role of young scientists. Many young persons during the war were taken directly from their studies and placed on important research teams where they assumed great responsibility. Most of these young men and women have now returned to school and are in a position to look back at their recent secondary school studies and evaluate them for teachers and for science-minded high school pupils. They are also looking ahead toward their work as scientists in a period of unparalleled technological advancement.

The theme for the first meeting of the Junior Scientists' Assembly is "The Young Scientist Looks at Education and at His Work." This meeting will be held at 2:30 Friday afternoon, December 27, in the Lobby Ballroom of the Bradford Hotel, Boston. Those invited to participate in the panel discussion include winners of the Science Talent Search, honorary members of the A. A. A. S. from the Junior Academies of Sciences, former members of science clubs and individuals whose initial progress in scientific work has been outstanding.

Special effort is being made to call the attention of science teachers and all scientists to the first Junior Scientists' Assembly. The Committee plans to make this Assembly a special feature of A. A. A. S. meetings, and it is interested in the cooperation of members of the Association who feel that it is their concern to guide the future of youth in Science.

NSTA NOMINATING COMMITTEE

The President of the NSTA has appointed the following Committee on Nominations for Officers and Board of Directors for 1947-1948:

Robert H. Carleton, Chairman
A. O. Baker
Will C. Burnett
Ira Davis
Ellis Haworth
Elbert E. Hedlee, and
T. A. Nelson

The committee will welcome suggestions as to names and procedures. Write to Mr. Carleton at 129 Beekman Road, Summit, New Jersey.

REORGANIZING BIOLOGY

Continued from Page 61

the entire textbook. And textbooks for the most part are still traditional in content and plan. One of the problems, therefore, in reorganizing biology is the selection of reading material which must be of great variety. Two textbooks differing in treatment of subject matter are better than one and a good library is an utmost necessity. *Concluded in next issue*

NEBRASKA CONDUCTS EXPERIMENT ON FILM USAGE

A STATE-WIDE project has recently been started in Nebraska for the purpose of studying (1) the effectiveness of sound motion pictures in supplementing other methods of instruction in selected courses; (2) the extent to which sound motion pictures may be used to enrich or extend the accomplishment in these courses; and (3) the efficiency of divisional distributing agencies in making films available for school use.

The Carnegie Corporation has made available $15,400 to be used for the development and administration of the program. Teaching Film Custodians, Inc. will furnish its own films without charge and in addition has advanced $5,000 to the program for the purchase and rental of other films to be used in the program. Encyclopaedia Britannica Films, Inc., has arranged to provide up to 600 of its own prints on an actual cost of production basis for the duration of the project.

The experiment is jointly sponsored by the Extension Division of the University of Nebraska, the State Department of Public Instruction and the Teachers College of the University of Nebraska. Teacher training institutions cooperating in the supervision of the project include the Teachers College of the University, Omaha Municipal University, and the state teachers colleges at Chadron, Kearney, Wayne and Peru.

The experiment will involve the utilization of classes in Physics, General Science, Biology, American History, World History and World Geography in each of twenty-nine experimental high schools.

Responsibility for the direct supervision of the project has been delegated to a committee of seven, the personnel of which is as follows:

Mr. John E. Lynch, State Teachers College, Chadron, Nebr.......................Area Director

Dr. H. G. Stout, State Teachers College, Kearney, Nebr..............................Area Director

Mr. Clifford Wait, State Teachers College, Wayne, Nebr.........................Area Director

Mr. Ernest O. Brod, State Teachers College, Peru, Nebr.............................Area Director

Continued on Page 90

MORE ABOUT WATER

Mr. Frank B. Wade
Shortridge High School
Indianapolis, Indiana

Dr. Mr. Wade:

I read your article, "After All, Water is Just Water," in the October SCIENCE TEACHER with much interest. I am glad to see one more person taking a crack at the discharge of sodium ions in the presence of hydrogen ions in the so-called electrolysis of water. Also, I am equally delighted to discover some support in the secondary school field for the discharge of the OH^- ion instead of the sulfate ion, for example.

I believe that we are justified in going only only so far with our explanations as we can verify by experimentally established data. For this reason I take issue with one point of your essay, namely the upsetting of the equilibrium $OH^- \rightleftarrows H^+ + O^{--}$ and the discharge of the oxygen ion at the anode. Experiments show that the reaction $4OH^- \rightarrow O_2 \uparrow + 2\,H_2O + 4e^-$ proceeds at -0.401 volts. This reaction is more likely under the conditions that you describe than the discharge of O^{--} ions.

The concentration of sulfide ions from hydrogen sulfide is in the orde rof magnitude of 10^{-100} m/1. Hence the O^{--} ion has too low a concentration to be effective and to act as does the sulfide ion.

It is of course obvious that adding NaOH as an electrolyte represses the dissociation of water into ions. While the reaction $H_2O + H_2O \rightleftarrows H_3O^+ + OH^-$ proceeds to give H_3O^+ concentration of 10^{-7} m/1, the H_3O^+ concentration of a 1M sodium hydroxide solution is 10^{-14} m/1.

For this reason, the addition of sodium sulfate rather than H_2SO_4 or NaOH allows us to give an explanation without the complicating factor of the common ion effect. We then conclude that at the cathode $2H^+ + 2e^- \rightarrow H_2$ proceeds much more readily than $Na^+ + e^- \rightarrow Na$; and at the anode $4OH^- \rightarrow 4OH + 4e^-$ proceeds more readily

$$\rightarrow 2H_2O + O_2$$

than $SO_4^{--} \rightarrow SO_4 + 2e^-$ or $20^{--} \rightarrow O_2 + 4e^-$.

Reasoning by analogy has its limitations, too. If we assumed that silicon and carbon

were closely alike we could arrive at some quite erroneous chemistry. This point is especially emphasized when we try to explain the difference between carbon dioxide and silicon dioxide.

The presence of the O^{--} ion revealed by X-ray analysis in sodium oxide is not surprising, for this compound is a typical salt of the electrovalent type of bonding. The presence of the oxygen ion in the solid or in the molten condition is quite another thing from assuming the presence of that ion in water. In fact, experimental evidence supports the contention that the oxide ion reacts 100 per cent with water. (See Sneed and Maynard GENERAL INORGANIC CHEMISTRY, p. 406). Hence I would not go along with your latter portion of the essay with as much comfort as with the first part.

Yours sincerely,
ELBERT C. WEAVER
Phillips Academy
Andover, Mass.

MYSTERIES OF LIFE

Continued from Page 58

ing them to contract. The problem is to find (1) how a stimulus is converted into the corresponding succession of impulses (2) how an impulse is transmitted (3) what the effect on the brain is and how a decision is reached, and (4) how impulses are modified in going from nerve to muscle.

THE MAIN progress to date has been in investigating the reaction of a single nerve fibre to electrical stimuli. If the stimulus is weak, the response is local; if the stimulus is strong, the response is propagated with a certain speed, which depends on the diameter of the fibre. (In humans, this may be as high as 100 meters per second). Because of the increase in knowledge of electronics, it has become possible to amplify small signals without introducing appreciable distortion, and to record rapid changes of potential accurately. The details of the nerve response may thus be scrutinized, and a satisfactory

picture of nerve action should emerge in the near future.

7. *Contraction of muscle.* Both biophysicists and biochemists have advanced the analysis of the mechanism of muscular contraction considerably. Delicate thermopiles have been used to measure the heat evolved during recovery, the analogy between muscle and rubber has been explored, and an apparently satisfactory scheme of the chemical reactions during recovery has been constructed.

When an excitation wave passes over resting muscle (which may be analogous to stretched rubber) it may loosen or break certain bonds and allow the myosin contractile elements to contract to their unstretched length. This is not a permanent condition for the muscle in the existing environment, and so a series of reactions ensues which tends to bring the muscle back to equilibrium with this environment, and incidentally stretches the muscle. The details of this picture have still to be constructed, but this should not take too long.

IF THE SUCCESS of the physicists in reducing the non-living world to order may be taken as any criterion, and we see no reason to the contrary, the present state of comparative ignorance about fundamental problems in biology cannot be of long duration. For every problem which can be formulated, and there are at present many very important ones, we should be able to construct solutions or to demonstrate why it is impractical or impossible. Biophysics and biochemistry should have a brilliant future, and the progress can be greatly accelerated if full encouragement is given to all able people who desire to contribute.

NEBRASKA EXPERIMENT

Continued from Page 87

Miss Ann Shannon, Municipal University, Omaha, Nebr. .... Area Director
Dr. Harold E. Wise, Teachers College University of Nebr. .... Area Director
Dr. Wesley C. Meirhenry, Extension Div. University of Nebr. .... Project Director

IMPORTANCE OF SCIENCE
Continued from Page 79

a course should be carefully coordinated by the education and science departments. One of the best of the general science texts could be used as a reference for a series of lectures given by science professors in their particular fields. A class in teaching methods and summer school work-shops could supplement such a general science course.

In order that everyone may have a basic knowledge of science, it is vital that educators set up a program of science instruction designed especially for the first nine grades. This can only be brought about by better training and placement of teachers and the use of new and attractive text books.

UTILIZING SCIENCE FILM
Continued from Page 78

3. Guide, stimulate and supervise individual students to continue their study activities into any field of interest aroused by the film topic or by the unit as a whole.
4. Integrate the activities which surrounded the seeing of the film with the remainder of the unit.

This plan of teaching, as you have noted, is the technique which a good science instructor has always utilized to teach any topic. Using a film in a science lesson does not change basic classroom teaching procedures, but it does make learning more purposeful and meaningful to our science students.

LEGISLATION NEEDED
Continued from Page 71

again be an attempt made to pass legislation providing Federal funds for parochial schools. A bill of this nature, in the recent Congress, was vigorously opposed by the National Education Association as well as by other groups of progressive educators and by labor. The secondary school science bill was sponsored by the Legislative Committee of our own National Association of Science Teachers.

The Science Teacher will keep you posted on pending legislation.

* "Science Instruction for All Citizens" by Dr. John C. Johnson of State Teachers College, Edinboro, Pennsylvania.

NSTA RECOMMENDS

Continued from Page 63

for rehabilitation in this area is most critical.

EACH SECTION of the report was prepared by a special sub-committee of National Science Teacher Association members who were especially qualified to deal with its subject matter. The Central NSTA Committee was comprised of the following members: Professor S. Ralph Powers, head of the department of the teaching of natural science, Teachers College, Columbia University; Ralph W. Lefler, coordinator, physics instructor, Purdue University; Dr. Glenn W. Blaydes, professor of botany, Ohio State University; Robert H. Carleton, head of science department, High School, Summit, N. J.; Dr. L. V. Domm, associate professor of zoology, University of Chicago; Dr. F. L. Fitzpatrick, professor of natural sciences, Teachers College, Columbia University; Dr. Philip G. Johnson, specialist for science, secondary education division, U. S. Office of Education; Dr. K. Lark-Horovitz, professor of physics and head of department of physics, Purdue University; Dr. Morris Meister, principal, Bronx High School of Science, New York City; Dr. Laurence L. Quill, head of department of chemistry, Michigan State College; Dr. G. M. Rawlins, head of science department, public schools, Washington, D. C.; Dr. G. A. Thiel, chairman of department of geology and mineralogy, University of Minnesota; Walter Wachter, physics teacher, Theodore Roosevelt High School, New York City; and Mr. Prevo L. Whitaker, science instructor and head of science department, University School, Bloomington, Indiana.

The members of the Cooperative Committee of the American Association for the Advancement of Science included: Dr. Glen W. Warner, American Association of Physics Teachers; Dr. Oliver J. Lee, American Astronomical Society; Dr. B. S. Hopkins, American Chemisal Society; Dr. Lloyd W. Taylor, American Institute of Physics; Dr. E. C. Stakman, Executive Committee of the A.A.A.S.; Dr. Raleigh W. Schorling, Mathematical Association of America; and Dr. E. H. C. Hildebrandt, National Council of Teachers of Mathematics.

BOOK SHELF

SCIENCE FOR EVERYDAY USE. Victor C. Smith, Ramsey Junior High School, Minneapolis, Minnesota; and B. B. Vance, Kiser High School and The University of Dayton, Dayton, Ohio. J. B. Lippincott Company, Chicago and Philadelphia, 1946. 732 pp. 491 illus. $1.96 list, less school discount.

Science for Everyday Use is a general science text suited to either eighth or ninth grade levels. The subject matter presented is selected from the usual areas covered as indicated by the five unit headings: *Matter; Energy; Life; Earth;* and *Man.*

It is keyed to the ability of the average student, but provides much material that even the poor student can understand as well as some to challenge the best minds. Some problems are introduced by describing experiments; others draw on the experience background of the student. Problems are usually closed with demonstrations or pupil activities that make use of the principles discussed. New words are listed at the close of the problem along with review questions, activities, and tests.

The book is profusely illustrated, interestingly written, and the language is well suited to the ninth grade level.

CHEMISTRY OF THE SILICONES. Eugene G. Rochow. Regional Laboratory, General Electric Company. John Wiley and Sons, New York City, 1946. 137 pp. Price, $2.75.

Introduction to the Chemistry of Silicones is a timely and scholarly book designed to acquaint chemists, engineers and industrial designers with the properties and the behavior in typical uses of this increasingly important class of compounds.

The first part of the book deals with the silanes and their derivatives to give some background of understanding in relation to the chemistry of the non-silicate compounds of silicon. The remainder of the text covers the more important silicon polymers, their preparation, properties and uses.

For the manufacturer it indicates the general procedure for making the polymers, the problems involved, and the materials and equipment required. Methods of analysis are included.

The book lists the numbers of some of the patents that cover specific products and also includes some references to other source material.

COMMUNICATION THROUGH THE AGES. Alfred Still. Murray Hill Books, 1946. 200 pp. Price, $2.75.

This book presents more than a chronological arrangement of technological development from sign language to television. The reader will find as well a review of the accompanying progress of man and of the changing philosophies as they are related to scientific and technical advance. This book should be of interest to the mature high school student as well as to the teacher of science.

New Government Publications of Interest to Science Teachers

DETERMINATION OF WATER QUALITY, by Ellis, M. M.; Westfall, B. A. and Ellis, Marion D. (Fish and Wildlife Service, Research Report 9) 122 p., 1946. Government Printing Office, 25c, Catalog No. 149.26:9.

This report presents detailed directions for collecting water samples and carrying through both exploratory and exact determinations of dissolved gases, minerals, alkalinity and acidity, suspended matter, hardness, as well as of effluents and trade wastes. Some of the tests such as the soap method for hardness are suitable for general science while others would be stimulating to chemistry and physics students. The significance of water quality to students of biology is emphasized throughout.

POISON IVY, POISON OAK, AND POISON SUMAC, by Crooks, Donald M. and Kephart, Leonard W. (Farmers Bulletin No. 1973, U. S. D. A.) 30 p., revised 1946. Government Printing Office, 10c, Catalog No. A1:9:1972/2.

Reveals the menace to health, the identification, and methods for eradication of these poisonous plants. Precautions against, and treatment for poisoning are also discussed. Suitable for general science and biology students and interesting to students of chemistry. Helpful to all science teachers.

PHOTOGRAPHIC SET PH-261, War Department Technical Manual 11-400. 35 p., 1945, (formerly restricted). Government Printing Office, 15c. Catalog No. W1:35:11-400/2.

Reveals a complete photographic kit with instructions for use. Of special interest to members of a photography club and other photography fans.

MALARIA, LESSONS ON ITS CAUSE AND PREVENTION FOR USE IN SCHOOLS, by Carter, H. R. and revised by Williams, L. L. (Public Health Reports Supplement No. 18) 23 p., 1943. Government Printing Office, 10c. Catalog No. FS2.8:18.

Facts about malaria presented in question and answer form. Covers the cause, infection, identification of carriers, life history, symptoms, treatment, and control. Useful to science teachers at elementary and higher levels.

INDEX TO VOLUME VIII

AUTHOR INDEX